Service Manual

for seca 780, 782

Variants:
7802317004
7802321004
7822321004
7822321604

Service Manual Number:
17-05-01-271- b
Valid as of: 01.10.00
Valid until:

Description:

Electronic column scale
Bearing determined lever system, double ending tuning fork Sensor, DETF-module with basic display.

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Functional description DETF basic scale

Introduction

The DETF basic scale is a mechanical basic module for various seca scales. It is used for the electronic determination of the weight of adults. For the electronic measurement of the mechanical quantitiy "force" a double-ended tuning fork sensor (DETF) is used.

The above principle of operation has been realized on the one hand with a knife-edged load lever system to meet higher accuracy requirements and on the other hand with a more cost effective bearing-determined load lever system to meet slightly lower requirements.

Weighing

When a load is placed on the scale, the force due to gravity is transferred from the platform (1) to the load lever system.

The long load lever (2) transmits the force via the bending element (5) on to the hook (6). The force is reduced in accordance with the transmission ratio of the load lever. The force applied to the short load lever (3) is added to the force on the long load lever via the centre suspension (4).

A bending load acts on the bending element that increases the tensile force acting on the pretensioned tuning-fork sensor (7). This increases its resonant frequency in a non-linear way, which is measured by the connected electronics (8) and converted into a weight using the stored characteristic curve. The weight is output on the digital display (9).

Overload protection device

The force acting on the hook is transferred to the overload protection device (10). This device is pressed against the platform by a pretensioned spring. If the load on the scale exceeds a permitted value, the spring yields and the load lever system is lowered.

Platform locking device

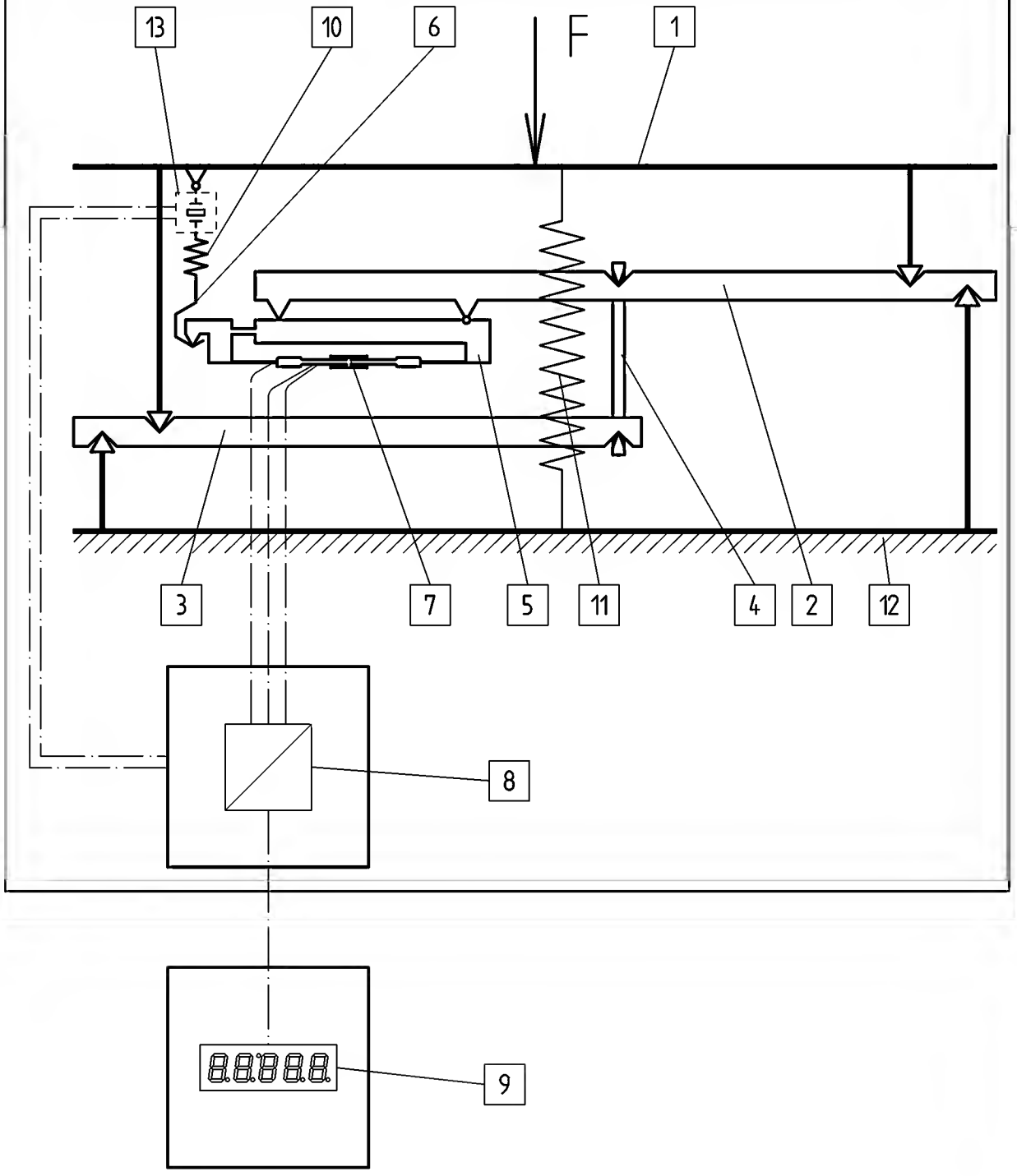
The platform retaining springs (11) do not only hold platform, frame (12) and load lever system together, but also exert an initial load which is necessary to reduce the hysteresis.

In the bearing-determined load lever system two springs exert a force which corresponds to a preload of approx. 15 kg.

In the knifed-edged load lever system 4 springs exert a force which corresponds to a preload of approx. 11 kg. The platform is prevented from being lifted by an additional locking device onto which the long load lever hits if the platform starts to rise (not for flat scales).

Vibration-sensitive switch (optional)

Any force exerted on the platform acts via load lever system, hook and overload protection device on the vibration-sensitive swich (13) which is fitted between overload protection device and platform. The load causes the vibration-sensitive switch to generate an electrical pulse which starts the connected electronics.



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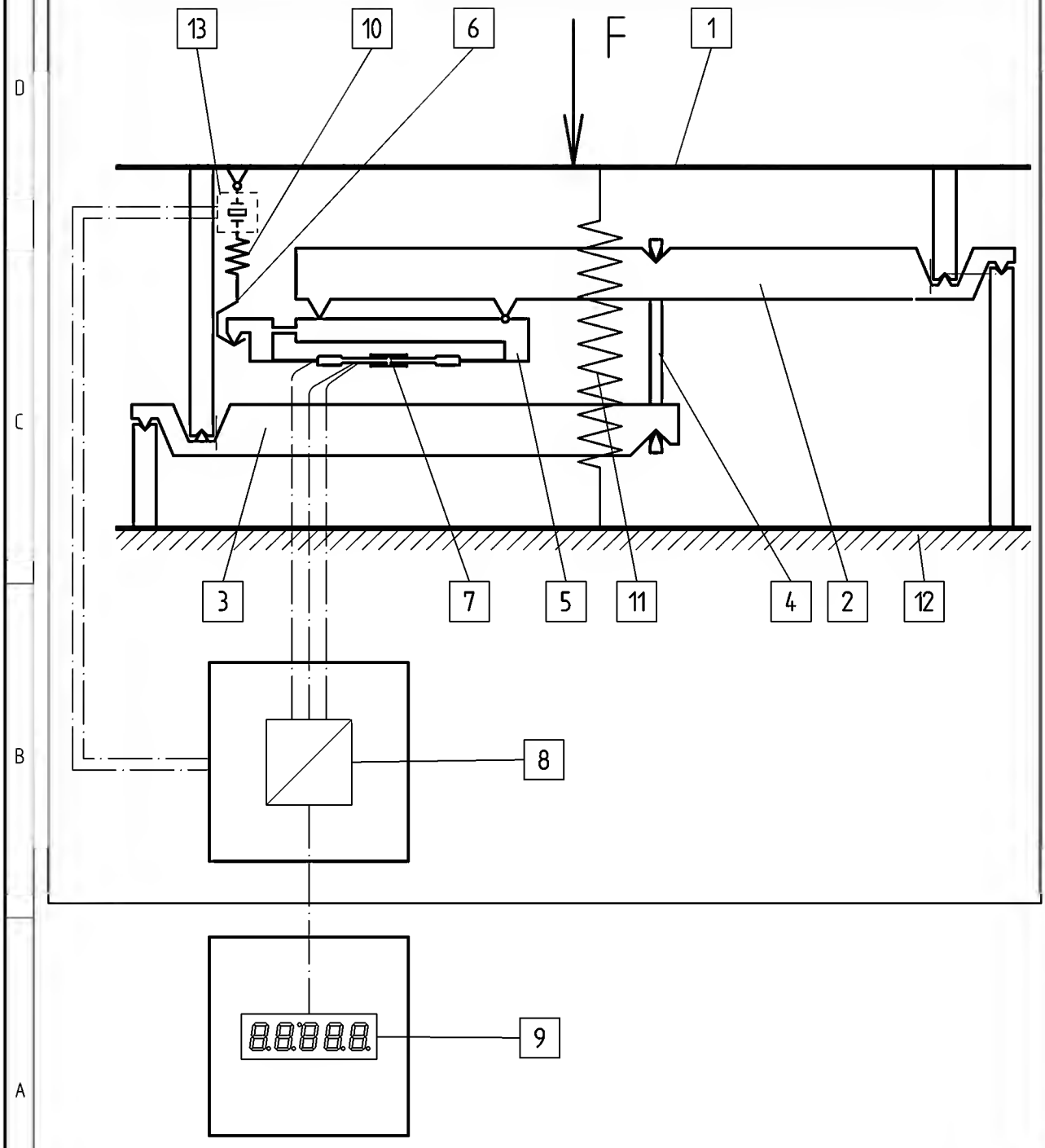
	Geprüft:	Panier	Datum:	Index:	a		

Maßstab:	Werkstoff:	Benennung:	Nr.:
		Function diagram DETF basic scale	30-34-00-629 Blatt 2



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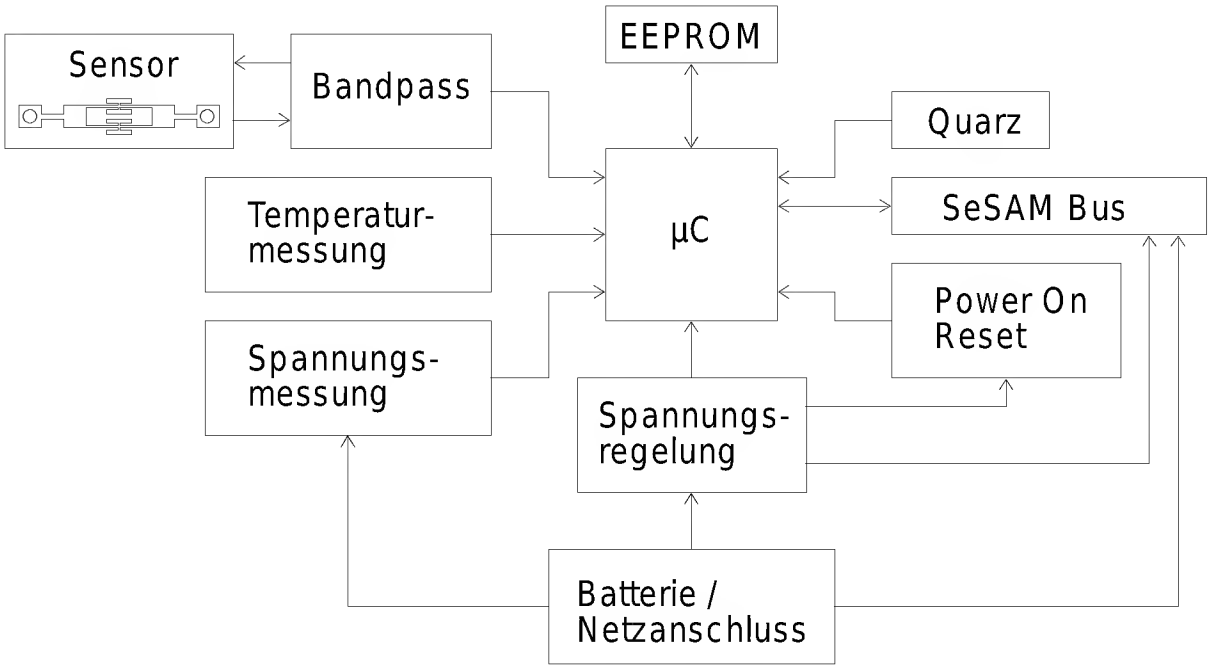
Maßstab:	Werkstoff:	Benennung:	Nr.:
		Function diagram DETF basic scale	30-34-00-629 Blatt 3

Brief description of the DETF module

Introduction

The DETF module belongs to the family of seca electronic modules and is used to determine weight by means of a tuning-fork sensor system. The weight obtained is displayed on a separate display module. To allow the module to be adapted to different scales, an EEPROM is integrated with which it can be configured. A connection to the SeSAM bus (Seca's Serial Autoconfiguring Multicontroller bus) is provided via which the scale can be calibrated and additional modules can be connected. The following block diagram shows the most important function blocks of the force sensor and the DETF module:



Weight measurement

A tuning-fork sensor screwed to a bending element is used as the weight sensor. If the scale is loaded, the bending element exerts a tensile force on the tuning-fork sensor, thus increasing its resonant frequency. By means of the bandpass filter the sensor is set vibrating at this frequency which is then measured by the microcontroller.
Using the value obtained and the individual calibration data stored in the EEPROM the controller calculates the weight.
The first value obtained after switch-on is used as the zeropoint. If the values obtained later on do not deviate strongly from this value, the zeropoint is corrected in order to compensate for possible drifts.
When the sensor is connected, care must be taken that the wires are not twisted to prevent crosstalk from the output to the input.

Temperature measurement

As the value measured by the tuning-fork sensor is affected by temperature, the temperature is measured regularly and compensated for accordingly.

Power supply

Power supply is provided by four AA size batteries and / or a seca mains transformer / desktop mains unit. From the power supply the voltage is passed via a reverse voltage protection diode to an in-phase regulator which provides a stabilized 3V supply voltage.

In order to avoid measuring errors due to almost flat batteries, their voltage is measured at regular intervals. If the voltage drops below a certain limit, the user is alerted by the battery symbol in the LCD. If the next threshold is undershot, „bAtt“ is displayed and weighing is no longer possible.
In order to extend the on-time when the scale is mains operated, the microcontroller receives a signal when a mains transformer is connected.
It is possible to use rechargeable batteries, but the batteries will not be charged in the scale.

EEPROM

The DETF module accommodates an EEPROM on which all parameters are stored that can be used to influence the program sequence, for example various limit values or the coefficients for determining the weight and for temperature compensation.
Furthermore, the scale can store values to be retrieved when the scale is switched on the next time, e.g. the modules last connected.

Serial bus

To allow the scale to be calibrated and additional modules, such as displays, to be connected, the DETF module is equipped with an interface to the SeSAM bus.
On this bus the stabilized and non-stablized supply voltages are available. Via a data and a clock pulse line all relevant data is transmitted to other modules. A special start line is provided via which the scale can be switched on or other modules can signal that they want to send data.

Fault handling

If faults occur, the SeSAM bus initiates a fault message with the relevant fault code. Furthermore, each fault message includes the number of the module type on which the fault has occurred and a code which indicates how long the message is to stay on display and which displays are to be suppressed.
The fault messages are transferred to the SeSAM bus and can be output by the display module (module type for the DETF module = 1).
The following fault messages are implemented:

10	20 bit counter overflow
11	Counts outside the permissible range
12	Switch-on zeropoint outside the permissible range
13	Zero follow-up outside the permissible range
14	Fault in the kg value calculation
15	Recalibration fault
20	Battery voltage too low
21	Fault in battery voltage measurement
22	Fault in temperature measurement
23	Temperature range exceeded (< 0°C or > 50°C)
30	General bus fault
32	Command buffer full
33	More than 8 slaves detected
40	EEPROM fault
41	Incorrect EEPROM access
50	Other fault

Instead of fault message 20 „bAtt“ is displayed and „temP“ instead of fault message 23.

Time base

From the quartz's 4.19MHz a time base is derived which controls all timed processes in the scale. These are, for instance, various timeouts and the on-time.
After expiry of the on-time, the supply voltage for the bandpass filter, for voltage measurement and for the EEPROM is switched off. All ports are set to zero-signal level and the quartz is stopped.

Recalibration

In order to compensate for linear measuring errors of the scale, which can, for instance, occur as a result of the different forces of gravity at different geographical points, the module has a recalibration function. Recalibration is performed via the SeSAM bus by means of a display module.

Technical data

Supply voltage:	2.7V - 15V
Supply current:	typ. 0.9mA
Quiescent current:	typ. 2µA
Operating temperature:	approx. 0°C to 50°C
Storage temperature:	-10°C to 60°C
Dimensions:	56mm x 38mm x 20mm

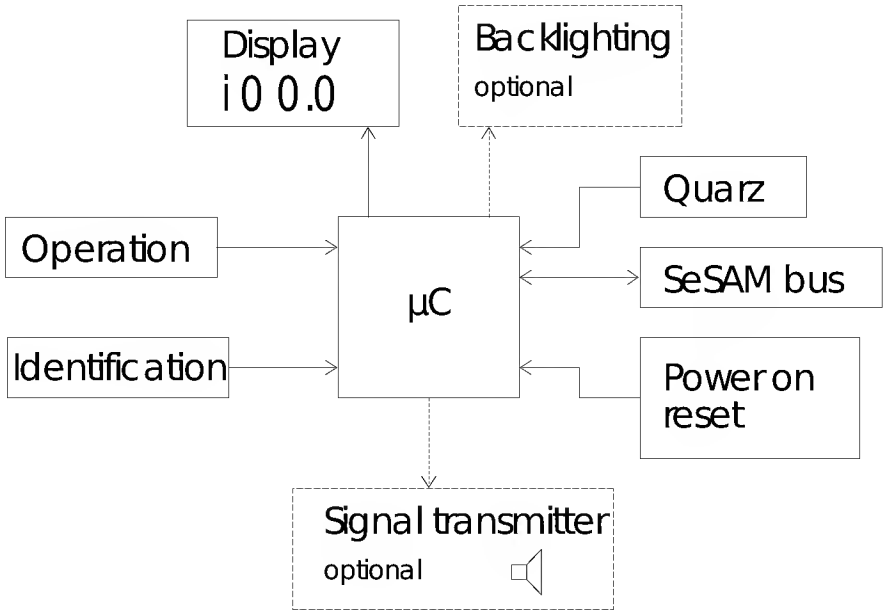
Zeichnungslegende

Sensor
Bandpass filter
Temperature measurement
Voltage measurement
EEPROM
Voltage control
Battery/mains connection
Quartz
SeSAM bus
Power on reset

Brief description of the display module

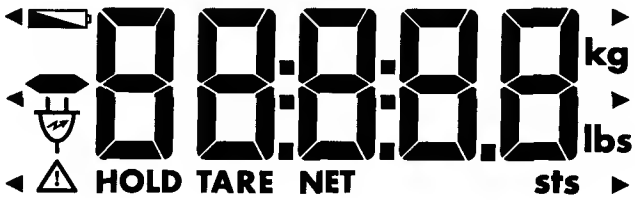
Introduction

The display modules belong to the family of seca electronic modules and are used to display a weight measured with a suitable module and transferred via the SeSAM bus (Seca's Serial Autoconfiguring Multicontroller bus). Furthermore, the display modules accommodate the operating elements and can process the weight (hold, tare, etc.).
The following block diagram shows the most important function blocks of the display modules:



Display

The weight displayed on the LCD is updated approximately every 0.8s. A maximum of five digits as well as a few special characters can be displayed, which can appear as shown below:



Explanation of the special characters:

- The battery symbol is used to alert of the fact that the battery is going flat.
- The plug symbol indicates that the scale is operated on a mains transformer.
- The warning triangle signals that the weight displayed on the scale is not verifiable.
- Hold indicates that the weight display has frozen.
- Tare or Net show that a weight on the scale has been tared out.
- The left and right arrows point to additional explanations next to the display.
- The weight units on the right show in which unit the measured weight is displayed.

Power supply

Power supply is provided via the SeSAM bus.

Operation

With the exception of a start button that might be available, the connected buttons can be configured as required for the particular model. These buttons can be pressed just lightly or longer (longer than 1.5s).
If you press another button when switching on the scale, the scale will switch to the verification counter and recalibration mode.

SeSAM bus

The SeSAM bus connects the display modules to the other modules. On this bus the stabilized and non-stablized supply voltages are available. Via a data and a clock pulse line all relevant data is exchanged. A special start line is provided via which the scale can be switched on or the module can signal that it wants to send data.

Identification code

If several display modules are connected, an unmistakable ID code must be assigned to them using soldering jumpers to ensure that the different modules are correctly addressed via the bus.

Backlighting (optional)

Some display modules are equipped with a power supply for LCD backlighting. It can either be lit when the scale is switched on or only when the scale is loaded.

Signal transmitter (optional)

Some display modules are equipped with a signal transmitter. A piezo diaphragm is used which is controlled with a 4 kHz square-wave signal.

Fault handling

If faults occur, the SeSAM bus initiates a fault message with the relevant fault code. Furthermore, each fault message includes the number of the module type on which the fault has occurred and a code which indicates how long the message is to stay on display and which displays are to be suppressed.
The display module displays its own fault messges on its LCD. Module type (for the display module = 3) and fault number are output. In addition, the fault messages that other modules have transferred to the SeSAM bus are displayed.
The following fault messages are implemented:

14	Fault in the kg value calculation
15	Recalibration fault
30	General bus fault
32	Command buffer full
33	More than 8 slaves detected
50	Other fault
51	Menu fault

Time base

From the quartz's 4.19MHz a time base is derived which controls all timed processes in the scale. These are, for instance, various timeouts.

Recalibration

In order to compensate for linear measuring errors of the scale, which can, for instance, occur as a result of the different forces of gravity at different geographical points, the module has a recalibration

function. To initiate the function, another button must be pressed when the scale is started. The verification counter is then displayed which is incremented whenever the scale is recalibrated. It enables the user to check whether the scale was manipulated. If, within five seconds, the button is pressed longer than 1.5 s, the scale switches to recalibration mode. The scale now measures the zeropoint and waits to be loaded with at least ¼ of the maximum load. By briefly pressing the button the weight displayed can be decremented or incremented in steps of 10g until the weight of the load placed on the scale is reached. The direction can be changed by pressing the button longer. To stop recalibration the button must be pressed longer than 5s. The scale can be switched off any time using the on/off button or by not actuating it for a while, thus aborting recalibration.

Optional functions

The functions "Tare", "Hold", "Autohold" and "Replace weight in repeat measurements" and various menu functions can be implemented via a program on the EEPROM (on the weight measuring module). The functions are explained below:

Tare:
The tare function can be assigned to a button by the EEPROM program. If the button is pressed, the weight is tared out as soon as the display has settled, if it is within the permissible range. Pressing the button again alternatively switches the tare function off or causes the weight to be tared out again.

Hold and Autohold:
If the hold function is assigned to a button by means of the EEPROM, the weight reading is held on display when the button is pressed as soon as the value has stabilized. Alternatively, the hold function can be automated so that the weight will always be frozen when it has exceeded a certain threshold and is stable.
The hold function is switched off after expiry of a predetermined time or by pressing the button again. In addition the scale can be configured so that the hold function will be deactivated when the scale is relieved, when the scale is relieved and then loaded again and / or when the load on the scale changes significantly.

Replace weight in repeat measurements:
The scale can be configured so that the weight last displayed is displayed again in a measurement when the scale detects that it has been loaded with almost the same weight.

Menu functions:
Not all the functions listed below can be activated on the same scale.
When the menu button is pressed long enough, the scale switches to the setting mode. Here, damping and weight display settings can be made.
When the button is pressed briefly, the scale switches to function mode. The following functions are possible:

- BMI: From weight and height the body mass index is calculated using the following formula $BMI = weight[kg] / length[m]^2$ BMI = weight [kg] / height [m]^2.
- IDE: The deviation from the ideal weight calculated using the formula $0{,}9 \times (length[cm] - 100)$ 0.9 (height[cm] - 100) is displayed.
- UL: When a limit weight is overshot or undershot an acoustic signal is generated.
- DIFF: The difference to a second weight is output. The second weight can have been measured using the autohold function, entered manually or stored when the difference function was last called.

Technical data

Supply voltage:	2.7V - 3V and 2.7V - 15V (via SeSAM bus)
Supply current:	typ. 0.5mA + power supply for backlighting (typ. 100mA)
Quiescent current:	typ. 2µA

Operating temperature:	approx. 0°C to 50°C	
Storage temperature:	-10°C to 60°C	
Dimensions:	74mm x 50mm x 23mm	small display
	100mm x 84mm x 21mm	large display
	67mm x 38mm x 23mm	backlit display

Please refer to the operating instructions to ensure that the scales were operated in the proper manner. In case of a malfunction, the following table will help you to locate the fault.

Description of the fault	Possible cause	Remedy
Scales cannot be started	• Battery is not installed or discharged	• Check the batteries
	• Voltage supply is defective	• Check the voltage at the appropriate connections of the electronics; eliminate the interruption
	• Bus connection cable is defective	• Check the plug-in connections; check the cables for interruption and replace them if necessary.
	• Keypad is defective or not connected	• Check the cable connections; check the cables and the keypad for interruption and replace them if necessary
	• Bus malfunction	• Disconnect the battery, wait for 60 sec. and connect the battery again
Scales show no weight or an incorrect weight (repeatedly)	• Packaging / transport safeguard has not been fully removed	• Check the scales
	• Scales are maladjusted	• Recalibrate the scales
	• Sensor is damaged	• Replace the sensor and recalibrate the scales
	• Load lever system is damaged or transfer of force to the sensor is interrupted	• Check the base frame (if present, the tie rod) for damage or incorrect assembly
Incomplete digits	• Display is defective	• Replace the electronics
Malfunction during the weighing procedure	• Display: Er :x:no	• The electronics have detected an error. ■ X: module number ■ No: error number
• Er :x:10	• Sensor is defective or not properly connected	• Check and, if necessary, replace the sensor (if the sensor is replaced, a recalibration is required)
• Er :x:11	• Sensor is defective or supply lines are damaged	• Check the input lines; check and, if necessary, replace the sensor (if the sensor is replaced, a recalibration is required)
• Er :x:12	• Initial load is too high	• Check the load lever (stuck or bent; check the sensor, replace it if necessary and carry out a recalibration

Description of the fault	Possible cause	Remedy
• Er :X:14	• Error during calculation of the kg value	• Incorrect coefficient in the read-only memory of the module; recalibrate the scales
• Er :x:15	• Error during recalibration	• Reference weight is outside the permissible range or operator error
• Er :x:21	• Error while measuring the battery voltage	• Battery voltage is far too low (< 2.5 V) or electronics are defective -> Replace the electronics
• Er :x:22	• Error while measuring the temperature	• Replace the electronics
• Er :x:32	• Error: command buffer overflow	• Check the cabling of the bus, eliminate any EMC malfunction, briefly (60 sec.) de-energize the electronics
• Er :x:40	• No EEProm data	• Recalibrate the scale or write the correct EEProm data by service program
• Er :x:41	• Incorrect EEProm access by the slave	• Check the slave; disconnect or replace the slave
• Er :x:50	• Other errors	• Error occurs directly after switching on -> wrong checksum in the ROM -> Replace the electronics
• Er :x:51	• Menu error	• Incorrect use of a menu function (wrong data e.g.), try it again

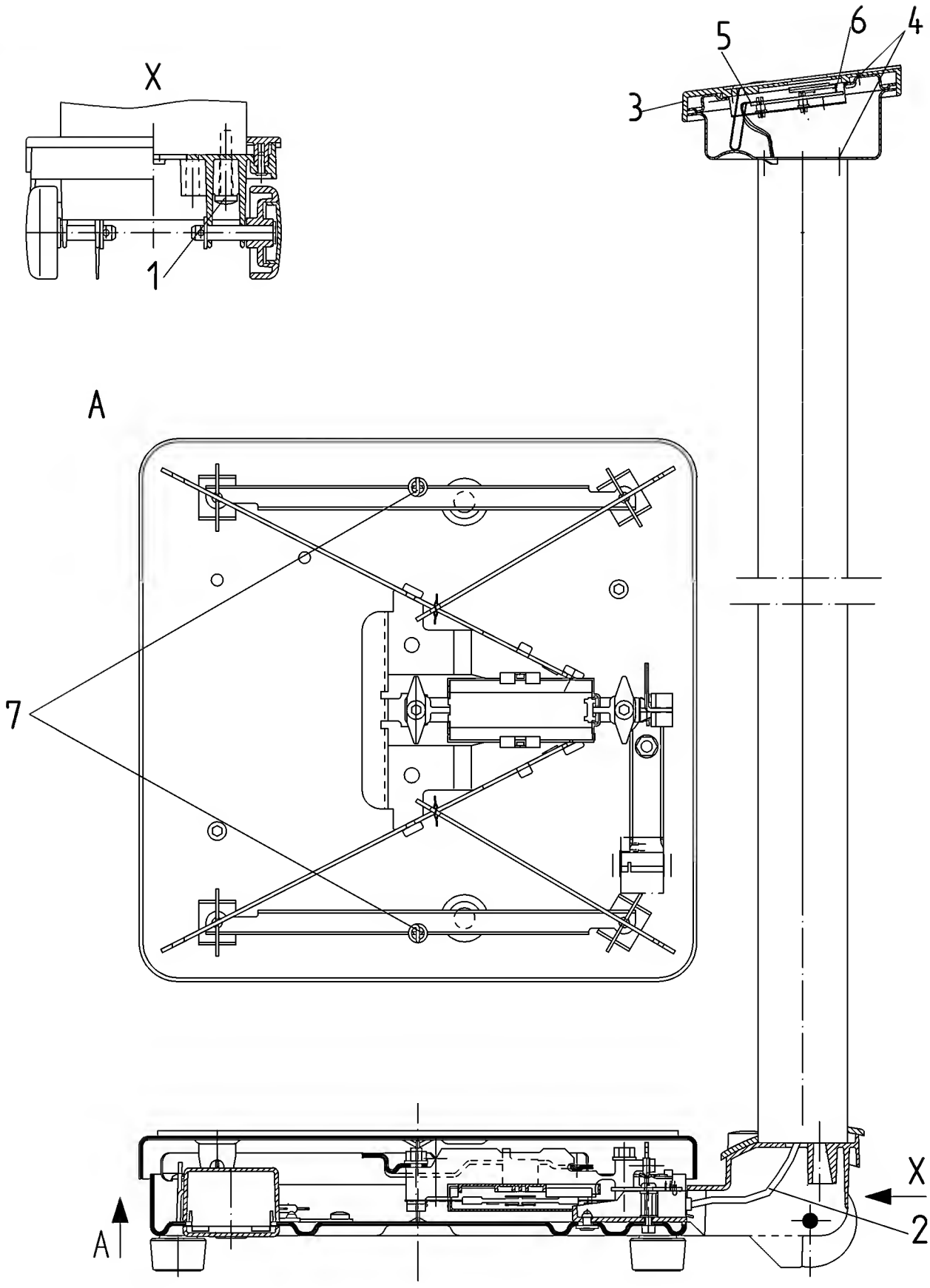
Drawing related to replacement instructions: 30-34-00-656.

Removal

- Pull the plug-in power supply unit's low voltage plug out of the socket in the base frame.
- Release the column's (1) screw connection.
- Unconnect the cable connection on the column. (2)
- Remove the cover on the display housing (3). It is engaged at 4 points.
- Release the display housing's (4) screw connection.
- Unsolder the membrane keyboard connections (5).
- Disengage the electronics board from its holder (6).
- Unhook the platform retaining springs (7).
- Set the base frame to its normal position and withdraw the platform.

Fitting

- Completely assemble the frame and fit the platform together with the platform retaining springs.
- Hook in the platform retaining springs (7).
- Snap the electronics board onto the holder (6).
- Solder the membrane keyboard connections back on (5).
- Screw the display housing tight (4).
- Snap on the display housing cover (3).
- Insert the column into the base frame and screw tight (2).
- Connect the cable on the baseframe.(1)



seca	Replacement mod. 780/782 Austauschanweisung 780/782	04.10.00 /Re 30-34-00-656 a Page 2/Blatt 2

Description of the calibration mode for scales with modular electronics

General:

Seca scales with modular electronics are fitted with a software-controlled calibration device that is operated using the existing controls. This device can be used to recalibrate the scales or to set the scales to different GAL values. During development of the calibration device, special attention was paid to the following requirements:

- It must be possible to recalibrate the scales without any additional external equipment/tools.
- It must be possible to calibrate the calibration device.
- It must be possible to recalibrate the scales without calibrated test weights.
- The calibration device shall be protected against inadvertent use.

Calibration counter

The scales fitted with the new, modular electronics are equipped with a calibration counter allowing a software recalibration to be carried out according to the requirements for calibrated scales. To carry out such a recalibration, the calibration counter setting can be called up on the display of the scales and compared to the data given on the calibration label mark (applies only for calibrated products). If the values are identical, the scales are calibrated; whereas differing values match the situation of a broken calibration seal. Each completed recalibration procedure is registered by the calibration counter, i.e. the number is automatically incremented by 1.

Recalibrating the scales

Before the scales can be recalibrated, they must be switched to the calibration mode:

To do so, switch on the scales using the appropriate control. While doing so, simultaneously press another control key (for example, the kg/lbs key). This causes the contents of the calibration counter (i.e. the number of calibration procedures carried out so far) to be displayed for five seconds (flashing).
During the 5 seconds the contents is displayed, press the kg/lbs key again and keep it depressed (for more than 1.5 seconds) to switch the scales to the calibration mode.
If the kg/lbs key is not pressed within these 5 seconds, the scales are automatically switched back to normal weighing operation.
When switched to the calibration mode, the scales first are in a decrementing state. This state is indicated by a flashing "dec" that alternates with the currently measured weight.

Now place a test weight onto the scales. This test weight should have a weight of at least 25% of the maximum permissible load for the weight (we recommend a weight of approx. 66-75%). The weight shown on the display must match the test weight; otherwise, the scales are maladjusted and the recalibration procedure must carried out in full length. To do so, change the weight shown on the display using the kg/lbs key until it matches the test weight.
If the value shown on the display differs from the test weight (if not, recalibration is not required), estimate whether the required nominal weight is easier to reach by *decrementing* or by *incrementing*. To toggle from the decrementing mode to the incrementing mode or vice versa, press the kg/lbs key for more than 1.5 seconds (display indicates dec or inc).

Pressing the kg/lbs key for less than 1.5 seconds causes the weight shown on the display to be increased or decreased by 10 g (depending on the mode currently selected). As the resolution of the display is lower, the displayed value will not necessarily be increased or decreased each time the kg/lbs key is pressed. Repeat the above procedure until the displayed weight and the test weight match. Set the scales to the middle between two division values by additionally incrementing or decrementing the value by n=d/(2*10). The calibration process can now be completed by pressing the kg/lbs key for at least five seconds. The scales compute and store a new linearity coefficient and will then be switched off automatically. The scales are now calibrated. Remove the test weight.

Note:
To prevent improper calibration by improper use, a timeout control has been implemented in the calibration mode, i.e. the time that passes until the next key is pressed must never exceed five seconds.

However, this timeout control is only active for the phase when switching to the calibration mode.
If, during this phase, 5 seconds have passed and no key has been pressed, the scales are automatically restored to the weighing mode so that the procedure must be repeated.

To reduce calibration errors to a minimum, recalibration is only possible using a test weight of more than 25% and less than 100% of the max. load; otherwise, “Er:0:15” will appear on the display.

If the scales need to be set to a different GAL value, the displayed value must be matched to the test weight value adapted to the GAL value correction.

Example of a recalibration procedure:

The selected test weight is 100 kg.
The current weight shown on the display is 99.7 kg (max. difference of 300 g).
In this example, you must switch the scales to the incrementing mode to carry out the recalibration procedure. After the kg/lbs key has been pressed (for more than 1.5 seconds), a flashing "inc" is shown.
Now increase the value by the first 10 g (by briefly pressing the kg/lbs key). After this has been done thirty times, the value 100.0 (rounded!) appears on the display although the internal measured value still is 99.95 kg (not rounded!).
To correct this rounding error, increase the value by another 10 g to get exactly 100.00 as the calculated value.
Terminate the recalibration procedure as described above.

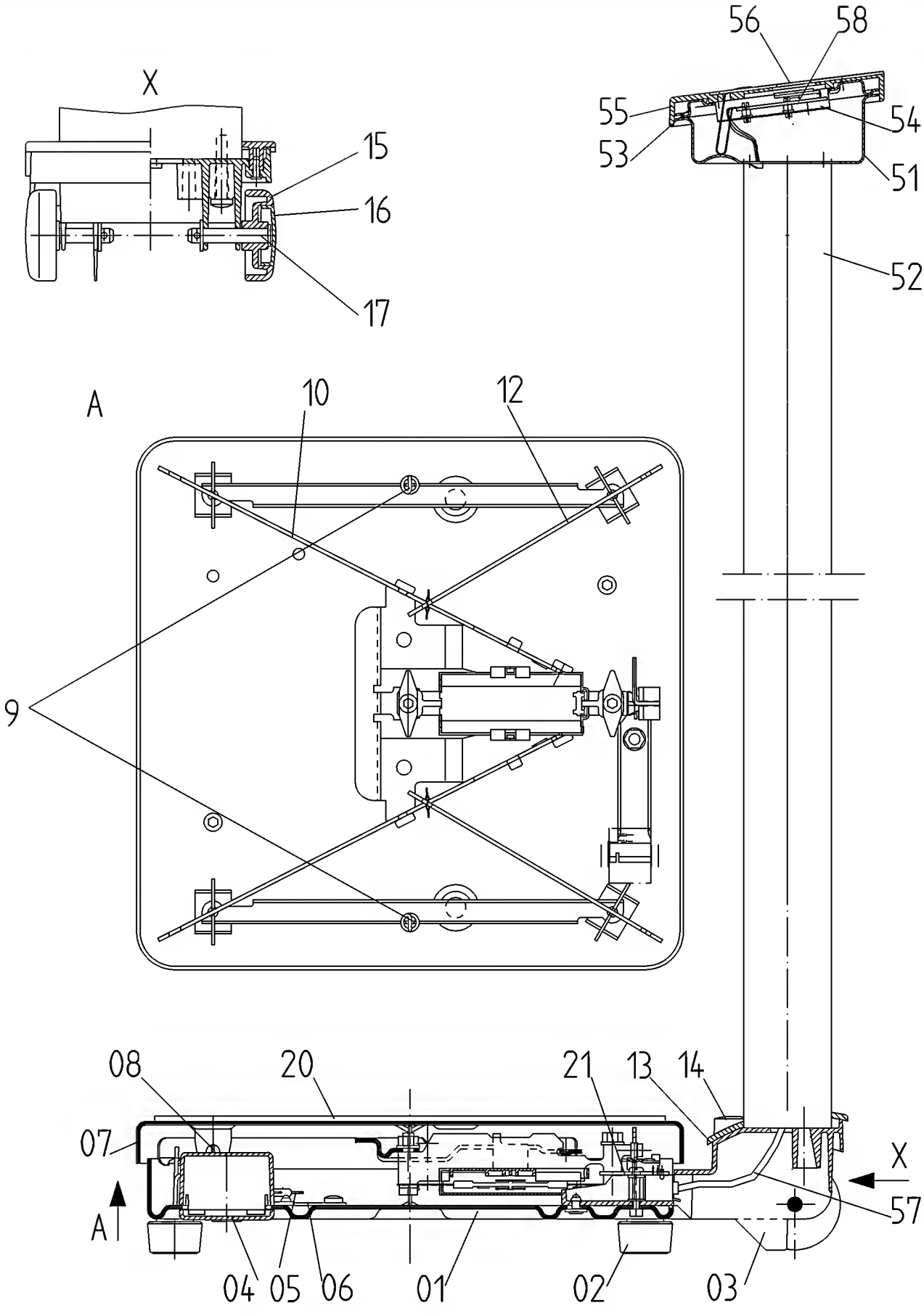
Summary of a typical recalibration sequence:

Action carried out by the user	Result
The scales are switched off.	No values or characters on the display.
Press the kg/lbs key and keep it depressed while simultaneously pressing the start key.	The contents of the calibration counter is shown on the display for 5 seconds (flashing).
Release both keys.	The contents of the calibration counter is shown on the display for 5 seconds (flashing).
Press the kg/lbs key for more than 1.5 seconds within the next 5 seconds.	The system switches to the calibration mode: first "dec" appears on the display (flashing) and then the current weight (0.0 - also flashing).
5 seconds have passed and no key has been pressed.	The scales are switched back to normal weighing operation.
Place the test weight onto the scales.	The measured weight of the test weight appears on the display (flashing).
Decide whether to decrement or to increment: <u>Incrementing:</u> Press the kg/lbs key for more than 1.5 seconds. <u>Decrementing</u>: No action required as the scales are already in the dec mode.	 The incrementing mode is activated; "inc" appears on the display. No output on the display.
Decrementing or incrementing: Again briefly press the kg/lbs key (for less than 1.5 seconds).	The measured weight is decreased or increased by 10 g. Please remember that pressing the key does not always change the value on the display due to the low display resolution. Only the rounded value is given.
Repeat this step until the measured weight matches the test weight (format: xx.0 kg).	The display indicates the test weight (format: xx.0 kg).
To correct this rounding error, decrement or increment the value five times by another 10 g.	The display output does not change the first four times.
After the fifth time the value has been decremented or incremented, the measured weight appears; it now matches the test weight.	The display indicates the exact test weight (format: xx.00 kg).
Press the kg/lbs key for at least 5 seconds until the system is switched off.	The display does not show any characters or values any more.

Item	Article no.	Designation	Price stage
1	02-01-03-135-509	Modular frame preassembled, complete	40
2	01-13-05-002-009	Foot	05
3	02-01-03-130-509	Column connection element, complete	26
4	08-06-14-239-009	Battery compartment	20
5	Depending on model: 08-06-16-096-119 08-06-16-094-119	 Harness for battery with pushbutton Harness for mains connection	 16 24
6	01-16-02-252-009	Mounting plate for mains connection	11
7	02-03-02-125-509	Platform, compl.	33
8	01-01-01-261-109	Pendulum suspension	08
9	01-07-01-293-009	Platform retaining spring	06
10	02-05-03-079-009	Load lever long, compl.	26
12	22-03-03-207-109	Load lever short	13
13	02-01-03-365-309	Cover, white	18
14	01-13-05-270-009	Plug, white	02
15	01-12-02-211-009	Roller d = 52	18
16	01-12-02-212-009	Cap	08
17	01-08-02-304-009	Bolt	14
18	66-30-60-015-009	Battery holder for 4 size AA batteries	13
19	68-11-03-015-009	Battery, alkaline manganese size AA MN 1500	07
20	Depending on the model: 02-04-02-225-009 01-13-04-223-009	 Cover for platform, white (mod. 780) Platform mat, ribbed (mod. 782)	 26 20
21	08-06-18-056-009	DETF – module	45

Item	Article no.	Designation	Price stage
51	08-04-05-323-008	Display housing, bottom part, light grey	18
52	04-02-06-215-008	Column, painted	34
53	08-04-05-322-009	Display housing, top part	16
54	01-16-02-253-009	Holder for display electronics	16
55	08-04-05-342-009	Cover for head	18
56	34-02-04-318-009	Front panel	28
57	08-06-16-115-119	Modular cable 1 m	18
58	08-06-18-064-009	Basicdisplay	40

Not shown in drawing:		
Depending on model:		
68-32-10-252-009	Plug-in power supply unit 230 V~ / 50 Hz | 12 V= / 130 mA	32
68-32-10-243-009	Desktop mains unit, switchable, 115 V~ / 230 V~ | 9 V= / 350 mA	32
68-32-10-246-009	Plug-in power supply unit 120 V~ / 60 Hz | 9 V= / 350 mA	32



seca	Spare parts list mod. 780/782 Ersatzteilliste Mod. 780/782	04.10.00 /Re 30-34-00-651b Page 3/Blatt 3